

CS 31: Intro to Systems

Course Introduction

Kevin Webb

Swarthmore College

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What This Class Is About

1. How a program executes on the hardware
2. The systems costs of program execution
3. An introduction to operating systems
4. Foundations of parallel programming

Instructor: Kevin Webb

- <http://www.cs.swarthmore.edu/~kwebb/>
- Please call me Kevin (or Professor/Dr. Webb)
- Research: Control platforms for networks
- Hobbies: Making stuff (woodworking, ceramics, electronics), cactus/fruit plants, PC games

Instructor: Kevin Webb

- <http://www.cs.sw>
- Please call me Kevin
- Research: Control
- Hobbies: Making (electronics), cactus



Office Hours

- Monday 1:00 – 2:30 PM
 - Tuesday 2:30 – 4:00 PM
 - By appointment
-
- 255 Science Center



Ninjas!



- Sessions Sundays 7-11 PM in 240

Amy



Charlie



Douglass



Jack



Martina



Zoe



Tonight (& tomorrow)

- Using Unix help session
 - 7:00 PM – 8:00 PM
 - Open to everyone
 - **If this is your first CS course here, you should go**
 - Location: Either SCI 240 or 256 (I'm not sure)

Resources

- Piazza Q&A Forum
 - <https://piazza.com/swarthmore/spring2016/cs31/home>
- Slides & audio on course website
- Lab sections:
 - Science Center 240
 - Wednesdays 8:50-10:20, 1:15-2:45, 3:00-4:30

Email Policy

- Please use Piazza rather than email
 - Your classmates benefit from your questions
 - Your classmates can answer your questions
 - I will check the forum frequently
- I will attempt to respond to within 24 hours
- If you do email me, please use kwebb@cs...

How does this class work?

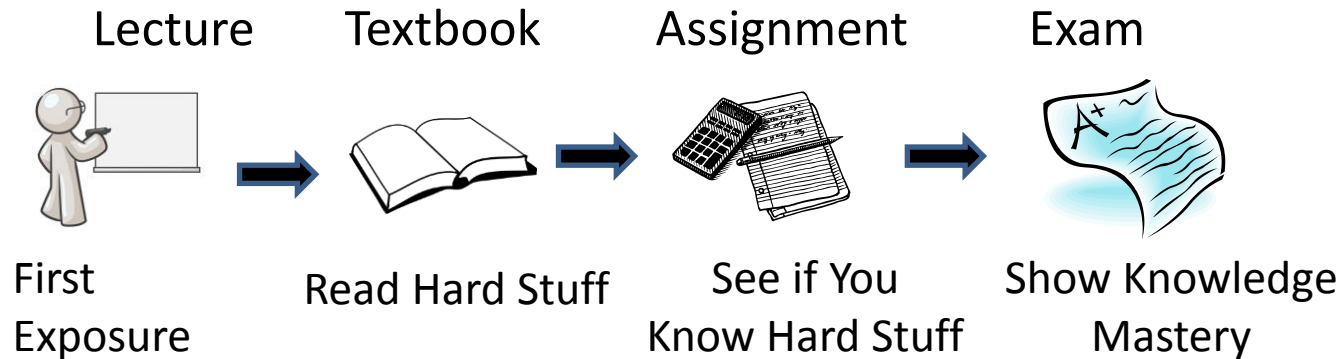
- This class is designed a bit differently from what you might normally be used to
 - Class will be centered around discussion
 - Requires your participation
- Ever considered why we have lectures?

Traditional Lectures:



- Roughly one millenium old

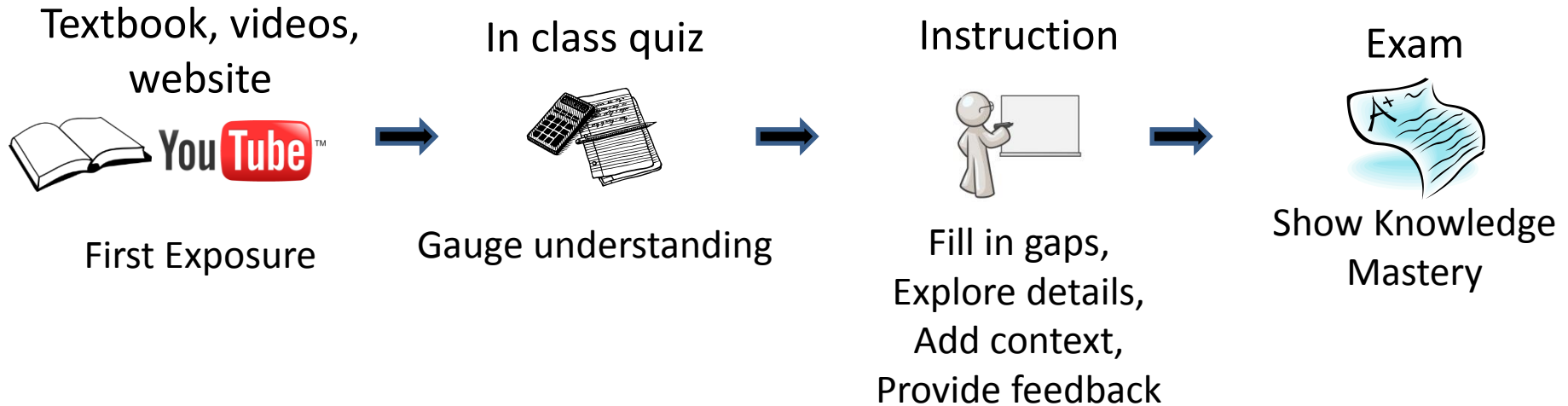
Traditional Lectures:



- Little opportunity for expert feedback
- Might as well skip class and watch video lectures!
 - (I am not actually suggesting this. Please attend your classes!)

Interactive Classes with Peer Instruction

- You do the “easy” part before class.



- Class is reserved for interactive, customized experiences
- Research on how people learn:
 - Everyone constructs their own understanding
 - To learn, YOU must actively work with a problem and construct your own understanding of it

Clickers!



- Lets you vote on questions in real time.
- Like pub trivia, except the subject is always systems.
- Please turn them off at end of class...

Peer Instruction

- Short quiz at the beginning of class
- During class: pose carefully designed questions
 - Solo vote: Think for yourself and select answer
 - Discuss: Analyze problem in teams of 3
 - Practice analyzing, talking about challenging concepts
 - Reach consensus
 - If you have questions, raise your hand and I'll come over
 - Group vote: Everyone in group votes
 - You must all vote the same to get your point
 - Class wide discussion:
 - Led by YOU (students) – tell us what you talked about in discussion that everyone should know!

Why Peer Instruction?

- You get a chance to think.
- I get feedback as to what you understand.
- It's more engaging!
- Research shows it promotes more learning than traditional lecture.

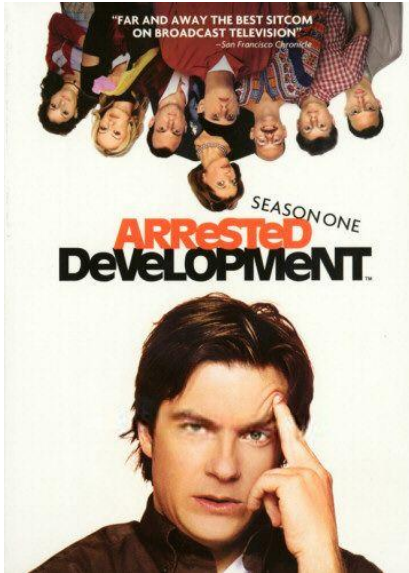
Giving out Candy

- To people willing to
 - Ask a question
 - Share an explanation
 - Summarize what their group talked about
- Your explanations are **CRITICAL** for fellow students' learning

Example Question

- Individual vote
- Group discussion / group vote
 - Room should be LOUD
- Class discussion

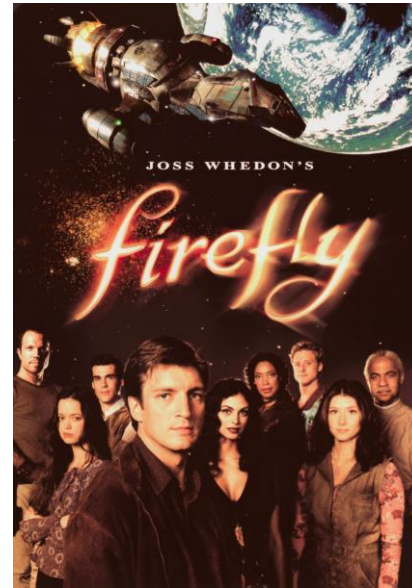
The best TV series is:



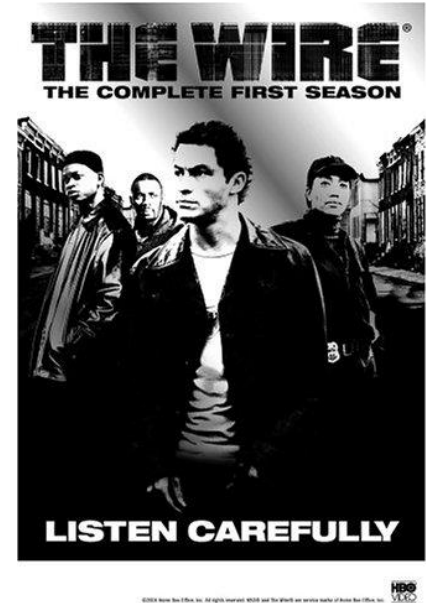
A



B



C



D

E: Some other series (be prepared to discuss what and why!)

Grading

- 5% Reading Quizzes
- 5% Class participation
- 25% Midterm Exam
- 30% Final Exam
- 35% Lab Assignments

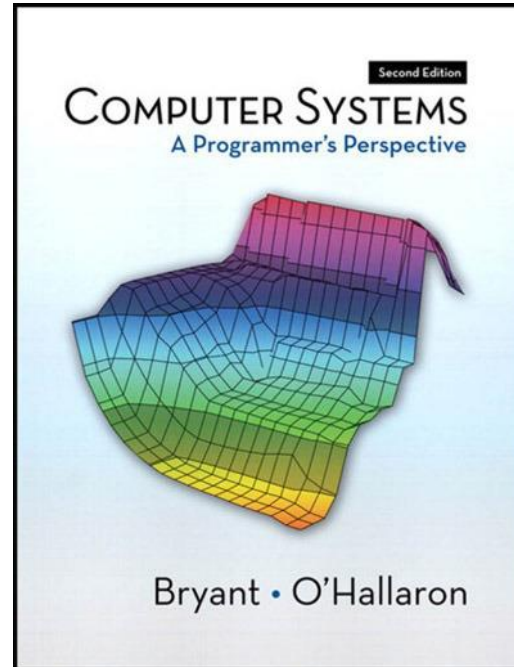
Grading

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 - 5% Class participation
 - 25% Midterm Exam
 - 30% Final Exam
 - 35% Lab Assignments
- I will drop your three lowest quizzes/no-shows.

Reading Quizzes

- Readings from online sources
- Target low difficulty: did you read?
- Goal: incentivize / reward preparation
 - Can be an easy 5%!
- You may bring handwritten notes.

Supplemental Textbook



- *Computer Systems: A Programmer's Perspective (6th Edition)*

Policies

- Collaboration
 - You may discuss approaches, not solutions
 - You must submit your own work
 - Exams may include questions on programming
- Cheating
 - Zero tolerance for cheating, don't do it!
- Lab Lateness
 - 48 hours of extra time for the semester

Tentative Schedule

- Midterm – March 3, in class
- Final - TBD
- Labs
 - Out on Wednesdays (lab section)
 - Due on Tuesdays

Administrative Questions?

- All of this info (should be) on class website
- Feel free to ask on Piazza discussion board

What is a computer system?

- Hardware and/or software that...
 - allows the user to interact with programs
 - allows programs to run and use machine's *resources*
 - makes computer easier to use
- Improves the computer's capabilities
 - performance
 - reliability
 - security
 - usability

Turn undesirable into desirable

- Turn undesirable inconveniences: reality
 - Complexity of hardware
 - Single processor
 - Limited memory
- Into desirable conveniences: illusions
 - Simple, easy-to-use resources
 - Multiple/unlimited number of processors
 - Large/unlimited amount of memory

Three big ideas

- Abstraction
 - What is the desired illusion?
 - How do we interact with it?
- Mechanism
 - How do we create the desired illusion?
 - How does it work?
- Policy
 - How do we make it work well, to meet a goal?

Why should you care?

- To know how your computer works
 - What may be wrong with your programs
 - How to enhance your computer, applications
- Systems programmers get respect
 - In high demand, get paid well
- Real-world impact

Pacman

- Pacman freaks out if you complete level 255

- Why?



Therac-25

- Anyone heard of this?
- Very similar to Pacman bug, only with tragic consequences.
- Radiation therapy machine, misdosed patients

Toyota Acceleration (2009-2011)

- Unintended acceleration
- ~9 million vehicles recalled
- “Stack overflow”

Mars Pathfinder (1997)

- Frequently locked up and stopped responding
 - (automatic reboot)
- “Priority inversion” in parallel software



Pokémon Yellow



- Cleverly “hacked”, game completed in 1:36
- “Buffer overflow” exploit

This Course

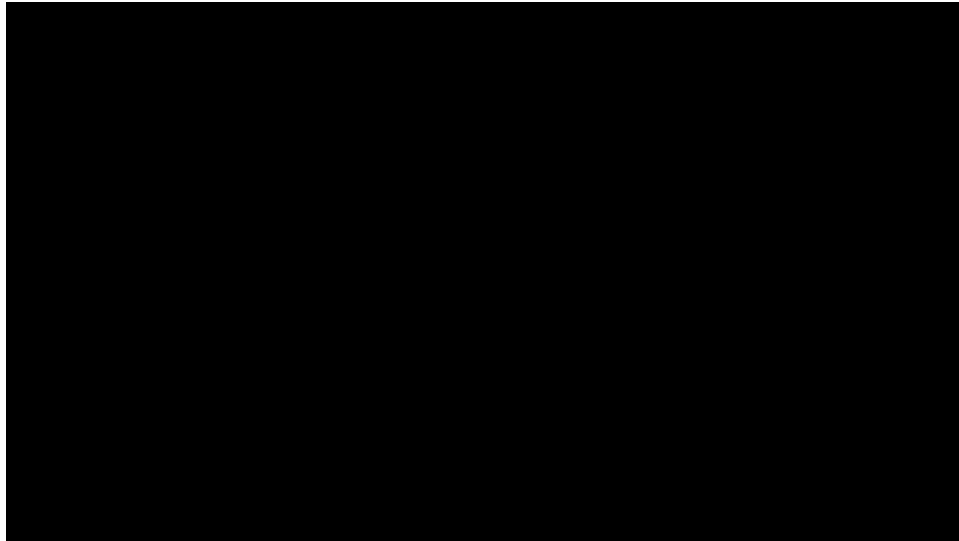
- How your programs *really* execute
- 1st half: focus on hardware execution
- 2nd half: focus on operating system

Clicker Registration

- <https://clickers.cs.swarthmore.edu>
- Can register for course or one-day loaner

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Your TODO list

- Reading posted on course web page
- Sign up for Piazza!
- Please let me know (emails ok) about:
 - Your preferred name, if different than roster name
 - Your preferred gender pronoun
 - Disability accommodations
- Register your clicker, if you didn't already...